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(51) INT CL<sup>7</sup>

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**G3T TA7C**

(56) Documents Cited

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(58) Field of Search

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**ONLINE : WPI, EPODOC, JAPIO.**

(54) Abstract Title

**Differential tourbillon escapement**

(57) A Differential Tourbillon Escapement for clocks and watches comprising a revolving carriage 6 with a twin escape wheel 13 escapement providing a double impulse. Each escape pinion 10,12 is coupled to separate co-axially mounted 4<sup>th</sup> wheels, one 13 rigidly fixed and the other 11 driven off a gear train. The whole carriage is pivoted on the same axis as the 4<sup>th</sup> wheels. The rotating 4<sup>th</sup> wheel 11 drives one escape wheel 1 and when that escape wheel is locked the drive to the other escape wheel 3 is via the whole carriage 6 that rotates around the fixed 4<sup>th</sup> wheel 13. One escape wheel gets a direct drive and the other drive by other rotating carriage. Only one of the two escape wheels is effective at any time. The carriage is not driven directly via a 4<sup>th</sup> wheel pinion as in other tourbillon or revolving carriage mechanisms.

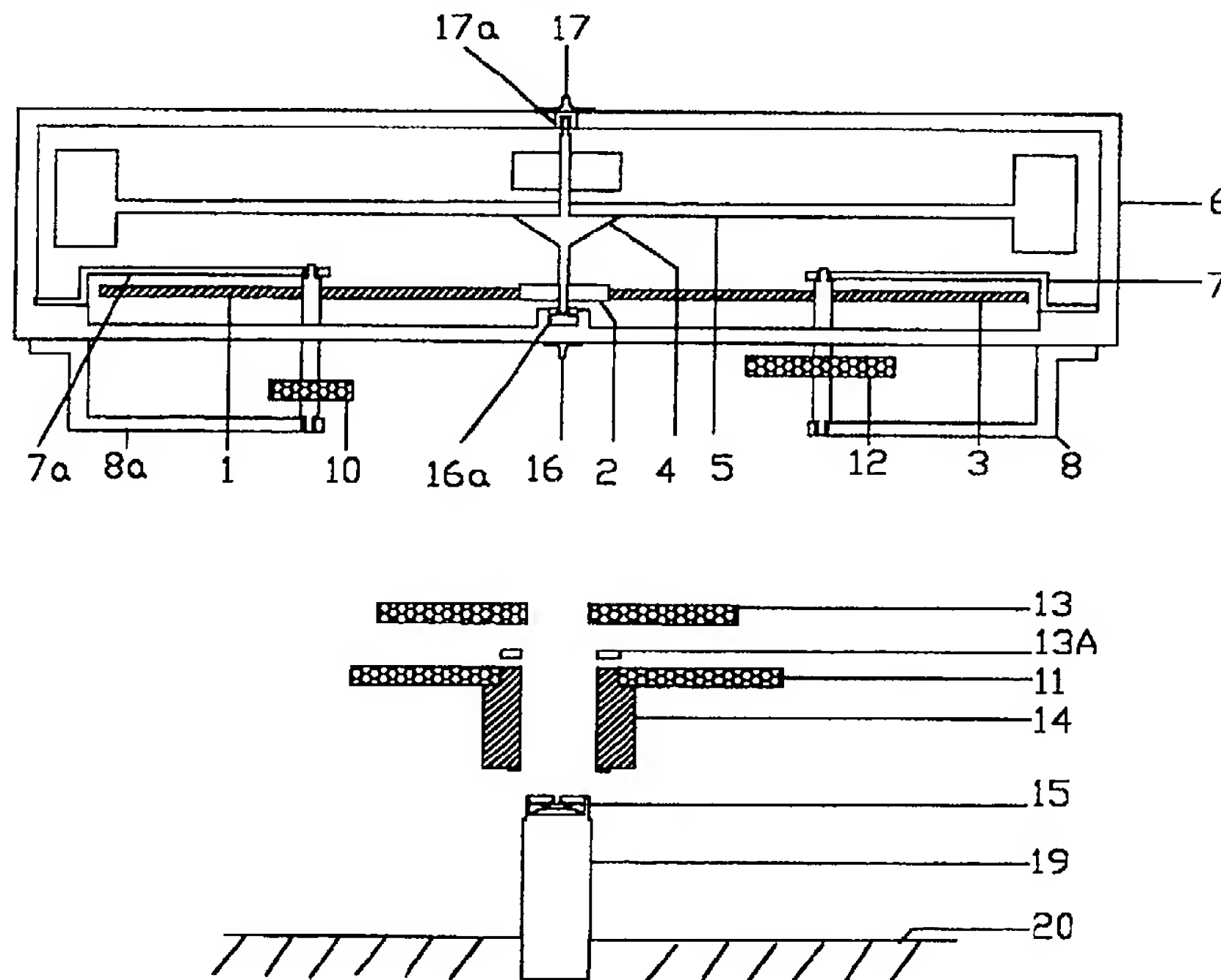
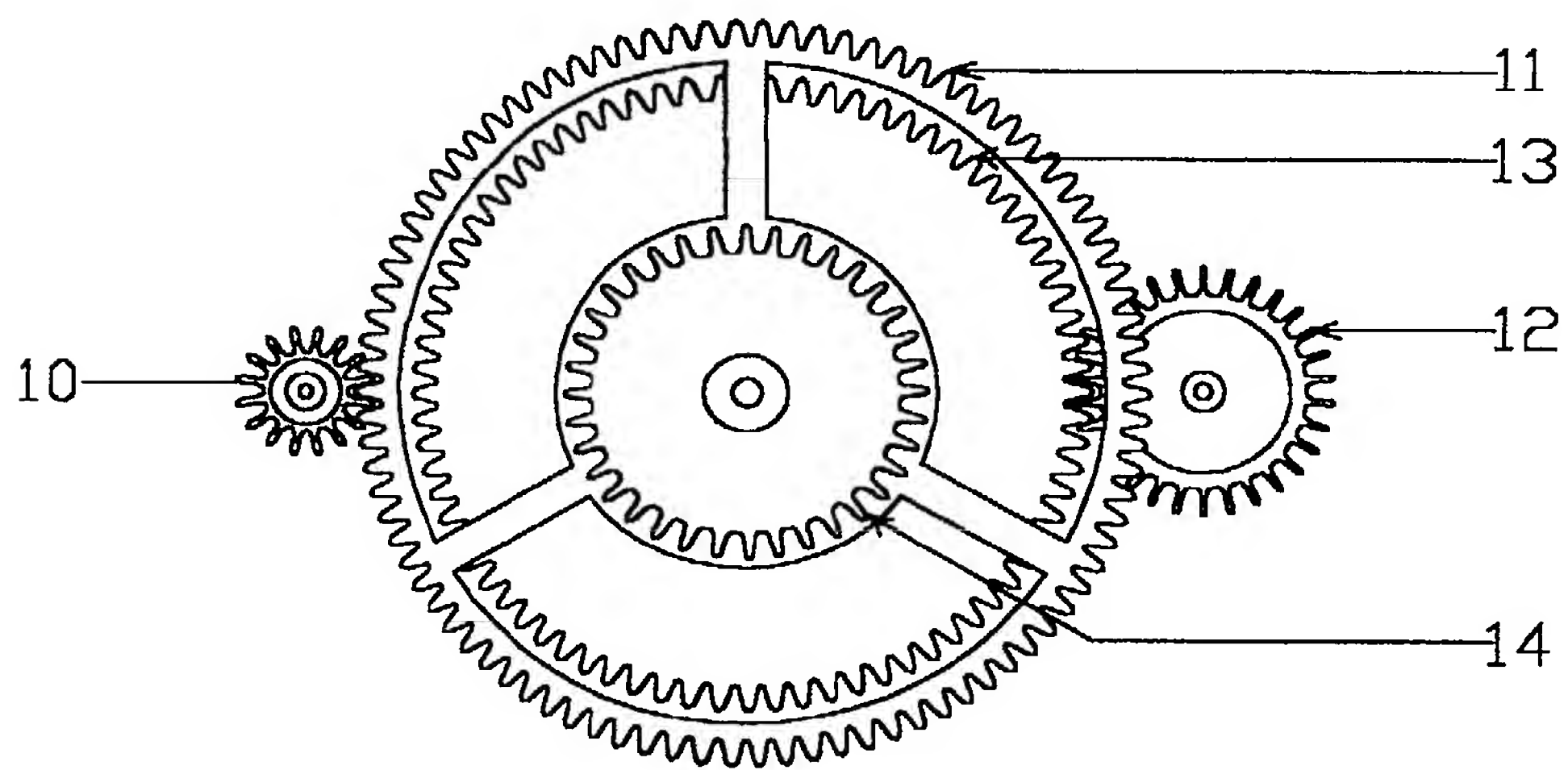
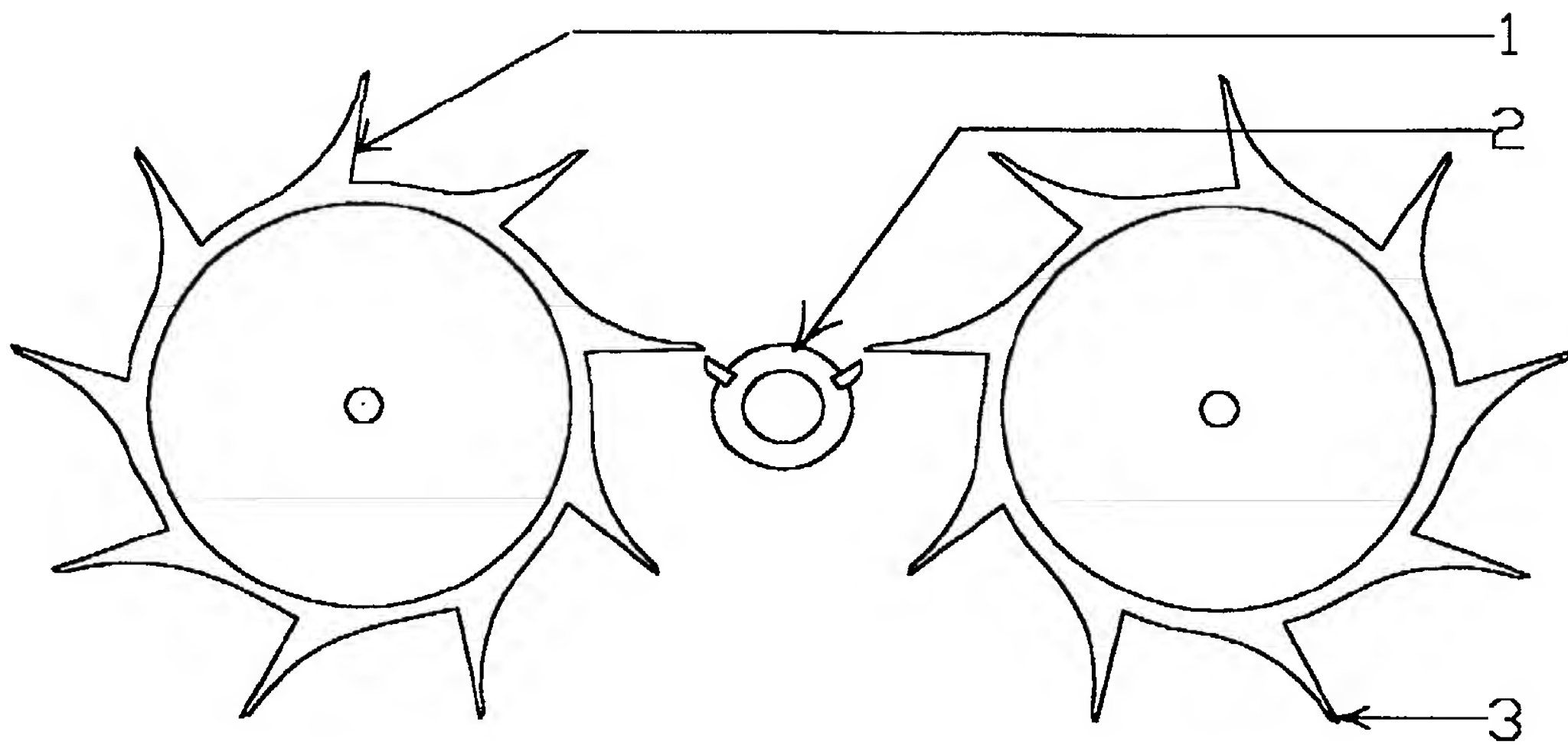


Fig 3.

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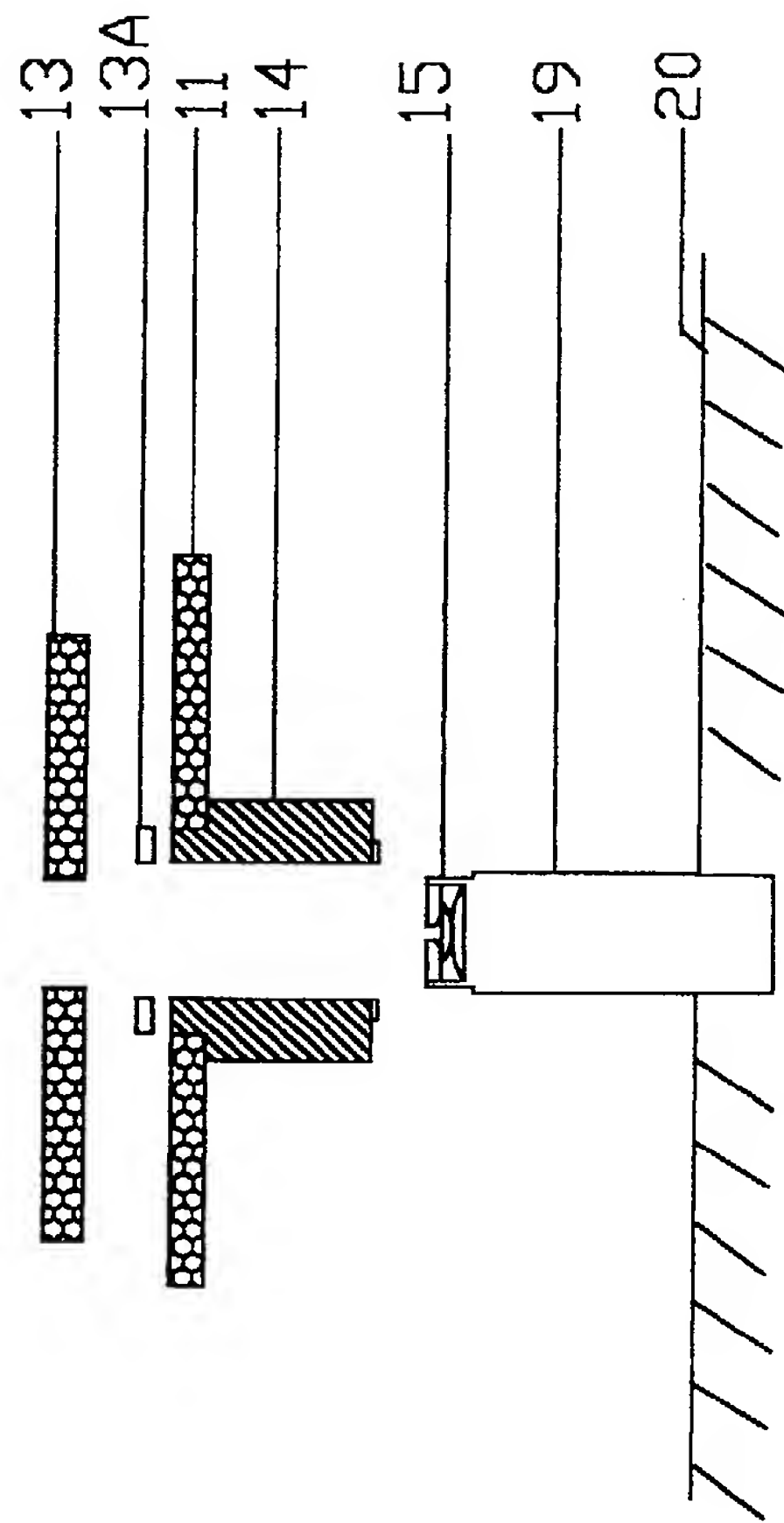
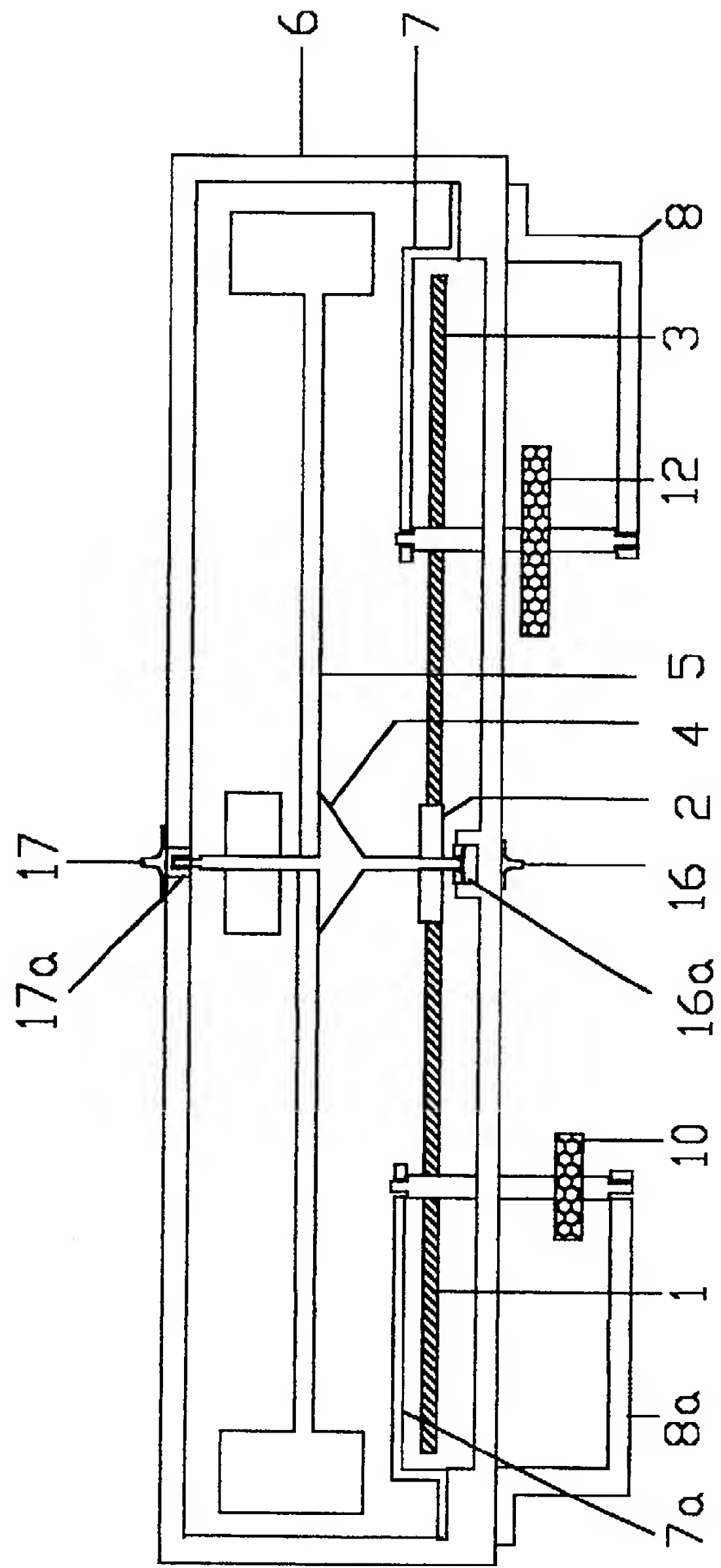


Fig 3.

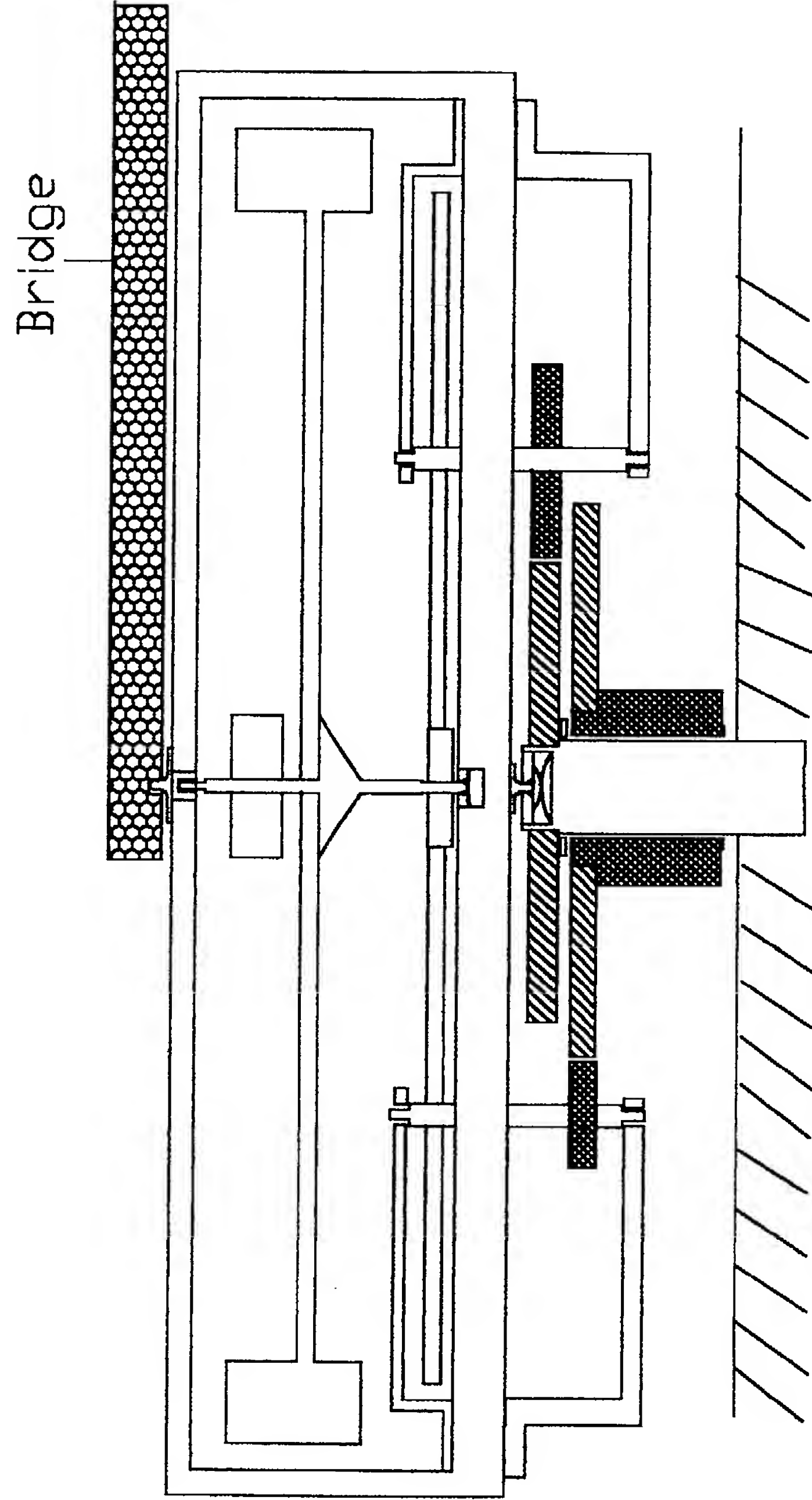


Fig 4.

**Differential Tourbillon Escapement**  
for clocks and watches.

This invention relates to a **Differential Tourbillon Escapement** mechanism or revolving carriage escapement, particularly designed for a double impulse escapement and which compensates suitably for the effects of gravity on the balance wheel assembly.

Hitherto known escapements found in mechanical clocks and watches are subject to a varying error due to the effects of gravity on the escapement which is fixed and rigid in design. No suitable means is available to neutralize the effects of gravity, especially when the balance is in the vertical position. A double impulse escapement is much desired for more stable timekeeping, and this is not always possible due to the power requirements of the gear train etc.

According to the present invention there is provided a Differential Tourbillon Escapement Mechanism comprising of two escape wheels, a balance and <sup>an</sup> escape wheel locking mechanism mounted in a revolving carriage, coupled by the respective escape wheel pinions to two co-axially mounted 4<sup>th</sup> wheels, one being fixed rigidly and the other driven by the movement train. The said escape wheels are mounted such that each escape wheel pinion makes contact with only one 4<sup>th</sup> wheel resulting in one escape wheel being driven by the moving 4<sup>th</sup> wheel and the other escape wheel being driven by the revolving carriage around the fixed 4<sup>th</sup> wheel.

The invention will now be described with the help of the following diagrams wherein :

Figure 1. Is a plan view of the twin escape wheels 1 & 3 along with the impulse roller 3. These three components along with two locking levers (not shown) are what form the tourbillon carriage. The balance wheel and balance spring are also not shown.

Figure 2. is an underside view of the two escape wheel pinions 10 & 12 that are mounted on 1 & 3 respectfully. The driving 4<sup>th</sup> wheels 11 & 13 are shown making appropriate contact with these pinions. 4<sup>th</sup> wheel driving pinion 14 is fixed rigidly to 11. Whereas 13 is fixed rigidly to stud 19. The 4<sup>th</sup> wheel pinion assembly comprising 11 & 14 moves freely around 19.

Wheels 13 and 11 are separated by washer 13A. Pinion 14 is driven by the movement train.

Figure 3. is an elevation section view of the complete tourbillon carriage. Only the 4<sup>th</sup> wheel assembly is shown partially exploded. The Balance wheel 5 is mounted between jewel bearings 16A and 17A.

Figure 4. is an elevation section view of the complete tourbillon carriage including the supporting bridge and base plate 20. The various components are shown at their various levels of co-operation.

The heart of the tourbillon mechanism is in the differential drive provided by the fixed and moving 4<sup>th</sup> wheels 13 & 11 respectively. The fixed and moving 4<sup>th</sup> wheels necessitate a moving carriage 6. The carriage has two pivots 16 & 17, and is mounted between an upper bridge and lower bearing assembly 15, that is on the top of the stud 19.

The working of Differential Tourbillon is described as follows:

If the carriage is stationary, wheel 11 drives pinion 10 activating escape wheel 1 as in any other mechanical escapement. This takes place when during one vibration of the balance, escape wheel 3 is locked by pinion 12 against fixed wheel 13. Thus the whole carriage is locked when escape wheel 3 is locked. The balance is given an impulse by escape wheel 1.

During the second half of the vibration of the balance (the opposite direction), escape wheel 3 is unlocked and escape wheel 1 is locked. This causes the entire carriage assembly 6 to be driven by 11 as if fixed to it via pinion 10. The escape wheel 3 is driven by the entire carriage revolving around fixed wheel 13. The tourbillon carriage is driven by a locked escape wheel 1 and not by a separate pinion fixed to the carriage as in other tourbillons. The difference in the size of the wheels 11 & 13 and mating pinions 10 & 12 is to compensate for the extra power needed when the entire carriage needs to be rotated to drive escape wheel 3. The lack of a carriage pinion to drive the carriage results in a significant decrease in carriage weight and hence power requirement.

The Differential Tourbillon Escapement Mechanism is operated as follows:

The clock or watch is wound to provide the motive power and the balance wheel is set in motion by any slight movement. The escapement is essentially self starting and needs no external control.



I Claim :

Claim 1.

A Differential Tourbillon Escapement Mechanism comprising of two escape wheels, a balance and escape wheel locking mechanism mounted in a revolving carriage, coupled by the respective escape wheel pinions to two co-axially mounted 4<sup>th</sup> wheels, one being fixed rigidly and the other driven by the movement train. The said escape wheels mounted such that each escape wheel pinion makes contact with only one 4<sup>th</sup> wheel resulting in one escape wheel being driven by the moving 4<sup>th</sup> wheel and the other escape wheel being driven by the revolving carriage around the fixed 4<sup>th</sup> wheel.

Claim 2.

A Differential Tourbillon Escapement Mechanism as claimed in Claim 1 wherein the revolving carriage is driven via the escape wheels.

Claim 3.

A Differential Tourbillon Escapement Mechanism as claimed in Claim 1. and Claim 2. wherein the 4<sup>th</sup> wheel assembly consists of one fixed wheel and one moving wheel co-axially mounted, the said moving wheel deriving its drive from the gear train of the movement.

Claim 4.

A Differential Tourbillon Escapement Mechanism as claimed in Claim 1, Claim 2 and Claim 3 wherein one escape wheel is driven by the moving 4<sup>th</sup> wheel directly and the other by revolving around a fixed 4<sup>th</sup> wheel.

Claim 5.

A Differential Tourbillon Escapement Mechanism as substantially described herein with reference to Figures 1,2, 3& 4 of the accompanying diagrams.



**Amendments to the claims have been filed as follows**

Claims

1. A Differential Tourbillon Escapement Mechanism comprising of two escape wheels, a balance and escape wheel locking mechanism mounted in a revolving carriage, coupled by the respective escape wheel pinions to two co-axially mounted 4<sup>th</sup> wheels of a gear train, one being fixed rigidly and the other driven by the movement train and wherein the said escape wheels are mounted such that each escape wheel pinion makes contact with only one 4<sup>th</sup> wheel resulting in one escape wheel being driven by the moving 4<sup>th</sup> wheel and the other escape wheel being driven by the revolving carriage moving around the fixed 4<sup>th</sup> wheel.
2. A Differential Tourbillon Escapement Mechanism as claimed in Claim 1 wherein the revolving carriage is driven or held via the escape wheels.
3. A Differential Tourbillon Escapement Mechanism as claimed in Claims 1 or 2 wherein the 4<sup>th</sup> wheel assembly consists of one fixed wheel and one moving wheel co-axially mounted, the said moving wheel deriving its drive from the gear train of the movement.
4. A Differential Tourbillon Escapement Mechanism substantially as described herein with reference to Figures 1, 2, 3 & 4 of the accompanying diagrams.



INVESTOR IN PEOPLE

Application No: GB 0111690.4  
Claims searched: 1-5

Examiner: Dave McMunn  
Date of search: 30 November 2001

## Patents Act 1977 Search Report under Section 17

### Databases searched:

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UK Cl (Ed.S): G3T (TA6B, TA7B, TA7C).  
Int Cl (Ed.7): G04B 15/08, 17/28.  
Other: ONLINE : WPI, EPODOC, JAPIO.

### Documents considered to be relevant:

| Category | Identity of document and relevant passage              | Relevant to claims |
|----------|--|--------------------|
| A        | GB 0,388,258 (VUILLEUMIER). note escape wheels 13 & 15 | 1                  |

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|---|---|---|--|
| X | Document indicating lack of novelty or inventive step   | A | Document indicating technological background and/or state of the art.  |
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